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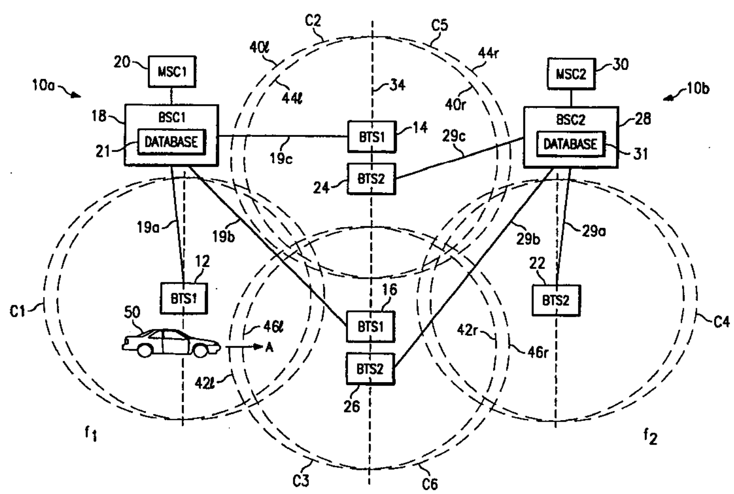

(57) Abstract

A method and system for triggering hard handoff of a call from a CDMA network cell operating on a first frequency to a cell operating on at least one second frequency or in an AMPS network are disclosed. In a departure from the art, a boundary sector handoff trigger is implemented in two stages. The first stage of the trigger occurs when the active set of a mobile unit consists only of pilots identified as boundary pilots; that is, the active set comprises a "boundary active set." Once the requirements for the first stage are satisfied, a second stage of the boundary sector trigger of the present invention is enabled. During the second stage, a round-trip delay ("RTD") of communications between the mobile unit and the BTS to which it is nearest is monitored and once the RTD exceeds a predetermined threshold, the trigger is complete and handoff processing continues with target selection and handoff execution.

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BOUNDARY SECTOR HARD HANDOFF TRIGGER

Technical Field

The invention relates generally to cellular communication networks and, more particularly, to a method of triggering hard handoff of a call from a cell operating on one frequency to a cell operating on another frequency.

Background of the Invention

In cellular telephone systems, the served area is divided into cells, each of which may be further divided into sectors. Each cell is served by a single base station transceiver subsystem ("BTS"), and each base station is connected to a mobile switching center ("MSC") via a base station controller ("BSC") and appropriate hardware links. A mobile unit is connected to the MSC by establishing a radio frequency ("RF") link with a nearby BTS.

Currently, there are several different types of cellular access technologies for implementing a cellular communication network, including, for example, time division multiple access ("TDMA"), advanced mobile phone services ("AMPS"), and, more recently, code division multiple access ("CDMA"). In a CDMA network, a single radio frequency is used simultaneously by many mobile units and each mobile unit is assigned a "code" for deciphering its particular traffic on that frequency. In contrast, in TDMA and AMPS networks, each mobile unit is assigned a different radio frequency on which to communicate.

Each sector of a CDMA network continuously outputs its own unique pilot signal. A mobile unit can distinguish between the sectors by the pilot signals emitted thereby and can also measure the strength of the pilot signal by measuring the carrier-to-interference ratio ("C/I") thereof. The strength of the pilot will indicate whether or not the sector with which it is associated can be used by the mobile unit to establish communication.

It well known that, in order for a mobile unit to communicate in a cellular communication network, several links must be established, including a radio frequency ("RF") link between the mobile unit and a base station transceiver subsystem ("BTS") and hardware links between the BTS and a base

station controller ("BSC") and between the BSC and a mobile switching center ("MSC"). In operation, as the mobile unit travels away from a first BTS and toward a second BTS, the RF link between the mobile unit and the first BTS will eventually become too weak to support communications therebetween and will eventually disconnect, resulting in the call in progress being dropped. Clearly, this is not an acceptable result.

To avoid this problem, as the mobile unit nears the second BTS, a new communications path between the mobile unit and the MSC, comprising an RF link between the mobile unit and the second BTS and hardware links between the second BTS and the MSC, is established. At this point, the mobile unit is directed to end communication with the first BTS and begin communication with the second BTS.

Although in the embodiment described above, the first and second BTSes are connected by a single MSC, it will be recognized that the BTSes may be connected by more than one MSC connected to one another via appropriate links. Moreover, the first and second BTSes may be located in two separate cellular communication networks, such as a CDMA and an AMPS network, respectively, or in CDMA networks using different operational frequencies.

The process of a mobile unit's terminating communication with one BTS and commencing communication with another BTS is commonly referred to as "handoff". The specific example of a handoff set forth above is referred to as a "hard handoff", because the link between the mobile unit and the first BTS is terminated before the link between the mobile unit and the second BTS is established. Hard handoff is implemented in older cellular communication technologies, such as AMPS, in which each mobile unit is assigned a different radio frequency on which to communicate. In contrast, in a CDMA network, "soft handoff", in which the second communications link is established before the first communications link is terminated, can be implemented, because the same frequency band is used for all communications within the CDMA network. Additional details regarding the specifics of the CDMA environment are described in TIA/EIA/IS-95-A, *Mobile Station-Base Station compatibility*

Standard for Dual-Mode Wideband Spread Spectrum Cellular System (hereinafter "IS-95"), which is hereby incorporated by reference in its entirety.

In all cellular communication technologies, handoff comprises three steps, including "trigger," "target selection," and "execution." The handoff trigger is the event that initiates the handoff processing. For example, in CDMA soft handoff, one type of handoff trigger occurs when a new pilot channel is received by the mobile unit with a strength greater than a threshold "T_ADD." Target selection refers to the process of determining which cell or sector is the most suitable server for the call. The handoff trigger initiates the target selection process. In CDMA soft handoff, the target selection process is built into the mobile unit and automatically occurs responsive to the handoff trigger. Handoff execution refers to the process in which the call is actually transferred to the target by the cellular communication network and includes activities such as hardware/software resource allocation.

The mechanism for accomplishing soft handoff in a CDMA network is fully documented in the IS-95 telecommunications standard; however, soft handoff can be accomplished only between CDMA cells that support identical CDMA frequency assignments. There are occasions where it is desirable to handoff a call between cells having different frequency assignments. For example, it is likely that different markets offering CDMA service will utilize different CDMA frequency assignments; therefore, a mobile unit traveling between those markets is required to undergo an interfrequency CDMA hard handoff in order to maintain the call.

Other situations in which it will be necessary to implement a hard handoff of a call in a CDMA network include handoff of a call from a multi-carrier CDMA coverage region to a single-carrier CDMA coverage region and handoff of a call from a CDMA network to a non-CDMA network.

The IS-95 telecommunications standard does not detail any mechanism to accomplish CDMA hard handoff. Unlike with CDMA soft handoff, with CDMA hard handoff, the mobile unit cannot provide much information to the CDMA network to facilitate the handoff. Accordingly, special intelligence must

be built into the CDMA network equipment and special deployment considerations must be observed to make such hard handoffs work reliably.

Therefore, what is needed is a method of triggering hard handoff of a call from a cell within a cellular communication network operating one a first frequency to a cell within a cellular communication network operating on a second frequency.

Summary of the Invention

The present invention, accordingly, provides a method and system for triggering hard handoff of a call from a CDMA cell operating on a first frequency (f_1) to a cell operating on a second frequency (f_2). In a departure from the art, a two stage handoff trigger, hereinafter referred to as a boundary sector trigger, indirectly utilizes the existing soft handoff algorithm implemented by the mobile unit to trigger the hard handoff.

In a preferred embodiment, overlaid pairs of bi-sectored cells, hereinafter referred to as "boundary cells," are deployed along the interfrequency boundary between the two networks. The sectors of these boundary cells, hereinafter referred to as "boundary sectors", are oriented normal to the interfrequency boundary. Each boundary cell is equipped with two BTSes, one operating on the frequency of the CDMA network and the other operating on the frequency of the other network. In one embodiment, the pilots associated with the boundary sectors are identified in a database of the BSC as boundary sector pilots.

During operation, as a mobile unit travels toward an interfrequency boundary into a region in which hard handoff is desired, a first stage of the boundary sector trigger of the present invention ("Stage 1") occurs when the mobile unit's active set, which comprises the set of pilots associated with sectors with which the mobile unit is in communication, consists only of pilots marked as boundary pilots in the database. An active set comprising only boundary pilots is referred to as a "boundary active set."

Once the requirements for Stage 1 are satisfied, a second stge of the boundary sector trigger of the present invention ("Stage 2") is enabled. During Stage 2, the round-trip delay ("RTD") of communications between the mobile

unit and the BTS to which it is nearest is monitored by the BSC. The RTD measurement serves as a rough estimate of the distance between the mobile unit and the nearest BTS. Once the BSC determines that the measured RTD exceeds a predetermined threshold specified in the database, the trigger is complete and handoff processing continues with the target selection process and handoff execution in the usual manner. It should be noted that if at anytime after Stage 2 has been entered and before handoff is initiated, the requirements for Stage 1 cease to be met (i.e., if the active set of the mobile unit ceases to be a boundary active set), the boundary sector trigger is disabled.

In one aspect of the invention, the boundary sector trigger is used to trigger a hard handoff of a call from a cell in a first CDMA network operating on a first frequency to a cell in a second CDMA network operating on a second frequency. In another aspect of the invention, the boundary sector trigger is used to trigger a hard handoff of a call from a cell in a CDMA network to a cell in a non-CDMA network.

A technical advantage of the invention is that it enables a call reliably to be handed off from a CDMA network operating on a first frequency to a cellular communication network operating on a second frequency.

Another technical advantage of the invention is that it enables a call reliably to be handed off from a multi-carrier region of cellular communication network coverage to a single-carrier region of cellular communication network coverage.

Yet another technical advantage of the invention is that, because the handoff takes place at a point at which both forward and reverse RF links are very robust, i.e., close to the cell site, the reliability and voice quality of the call are very high.

Yet another technical advantage of the present invention is that "ping-ponging," that is, handoff of a call from one frequency to another and back to the first almost immediately, is prevented because the point at which f_1 to f_2 handoff occurs is separated in space from the point at which f_2 to f_1 handoff occurs.

Brief Description of the Drawings

Fig. 1 is a system block diagram of an interfrequency boundary region between two cellular communication systems operating on different frequencies for illustrating the operation of the boundary sector trigger of the present invention.

Fig. 2 is a flowchart illustrating the operation of the boundary sector trigger of the present invention.

Fig. 3 illustrates use of the boundary sector trigger of the present invention to handoff a call from a multi-carrier region to a single-carrier region.

Description of the Preferred Embodiment

Fig. 1 illustrates an interfrequency boundary region between a first cellular communication network 10a operating on a first frequency ("f_1") and a second cellular communication network 10b operating on a second frequency ("f_2") different than that of the first cellular communication network 10a. As shown in Fig. 1, the first cellular communication network 10a comprises a plurality of cells, only three of which, C1, C2, and C3, are shown for the sake of clarity. Each cell C1, C2, and C3, is served by a respective base station transceiver subsystem operating on f_1 ("BTS1") located at a cell site thereof; in particular, the cell C1 is served by a BTS1 12, the cell C2 is served by a BTS1 14 and the cell C3 is served by a BTS1 16. Each BTS1 12, 14, 16, is connected to a first base station controller ("BSC1"), designated in Fig. 1 by a reference numeral 18, via a hardware link 19a, 19b, 19c, respectively. The BSC1 18 is connected to a first mobile switching center ("MSC1"), designated in Fig. 1 by a reference numeral 20, via a hardware link. In a presently preferred embodiment, the BSC1 18 includes a database 21 for purposes that will be described below.

Similarly, the second cellular communication network 10b comprises a plurality of cells, only three of which, C4, C5, and C6, are shown for the sake of clarity, and two of which, specifically, cells C5 and C6, form overlaid pairs of cells with cells C2 and C3, respectively, of the first cellular communication network 10a for purposes to be described in detail below. Each cell C4, C5, and C6, is served by a respective base station transceiver subsystem operating on f_2 ("BTS2") located at the cell site thereof; in particular, the cell C4 is served by a

BTS2 22, the cell C5 is served by a BTS2 24 and the cell C6 is served by a BTS2 26. Each BTS2 22, 24, 26, is connected to a second BSC ("BSC2"), designated in Fig. 1 by a reference numeral 28, via a hardware link 29a, 29b, 29c, respectively. The BSC2 is connected to a second MSC ("MSC2"), designated in Fig. 1 by a reference numeral 30, via a hardware link. In the preferred embodiment, the BSC2 28 includes a database 31 for purposes that will be described below.

In accordance with features of the present invention, each of the cells C2, C3, C5, and C6, are designated as "boundary cells," due to the fact that they lie on the boundary between the cellular communication networks 10a and 10b. As boundary cells, the cells C2, C3, C5, and C6, are bi-sectored cells oriented normal to an interfrequency boundary 34 between the cellular communication networks 10a and 10b such that the boundary between the each pair of sectors of the boundary cells C2, C3, C5, and C6 lies substantially along the same line as the interfrequency boundary 34. In particular, the cell C2 comprises sectors 40l and 40r, the cell C3 comprises sectors 42l and 42r, the cell C5 comprises sectors 44l and 44r, and the cell C6 comprises sectors 46l and 46r. In accordance with features of the present invention, the pilots of the sectors 40r and 42r are identified in the database 21 as boundary sector pilots, while the pilots of the sectors 44l and 46l are identified in the database 31 as boundary sector pilots. For ease of explanation, the non-boundary cells C1 and C4 are shown as being unidirectional cells, although use of any other type of cell configuration (e.g., three- or six-sector) is supported.

In operation, as a mobile unit 50 initially located within the cell C1 and in communication with the BTS1 12 moves in a direction indicated by an arrow A, it enters soft handoff with the cell C1 and the sector 42r of the cell C3, meaning that the cell C1 (a non-boundary cell) and the sector 42r (a boundary sector) are in the active set of the mobile unit 50; hence, the active set is not a boundary active set. As the mobile unit 50 continues to travel in the direction indicated by the arrow A, it eventually reaches a point at which it is in communication only with the sector 42r, and/or any number of other boundary sectors. Accordingly, the active set of the mobile unit 50 is now a boundary

active set, such that the condition for Stage 1 of the boundary sector handoff trigger is met and Stage 2 thereof is enabled.

As the mobile unit 50 continues to move in the direction indicated by the arrow A, the RTD of communications between the mobile unit 50 and the nearest BTS, in this case, the BTS1 16, is monitored. When the RTD exceeds a predetermined threshold, the condition for Stage 2 of the boundary sector handoff trigger is met and target selection processing begins.

In the illustrated, and presently preferred embodiment, it will be recognized that the cell deployment strategy is such that the target selection process will result in the selection of the sector 46r, served by the BTS2 26. Once a target (i.e., the sector 46r) is selected, the BSC1 18 then initiates hard handoff from the sector 42r in the f_1 coverage region to the sector 46r in the f_2 coverage region. The mobile unit 50 continues traveling in the direction indicated by the arrow A and enters soft handoff with the cell C4 on f_2.

It should be noted that the second cellular communication network 10b may be either a CDMA or a non-CDMA. Moreover, although as shown and described with respect to Fig. 1 as being connected to independent MSCs, it will be recognized that both the BSC1 18 and the BSC2 28 may be connected to the same MSC.

Referring to Fig. 2, operation of the boundary sector trigger of the present invention will now be described in greater detail. In step 200, a determination is made whether the active set of the mobile unit 50 on the active traffic channel is a boundary active set. If not, execution returns to step 200; otherwise, execution proceeds to step 202. In step 202, the RTD of communications between the mobile unit 50 and the BTS to which it is closest is measured. In step 204, a determination is made whether the RTD measured in step 202 is greater than a predetermined threshold value. If not, execution returns to step 200; otherwise, execution proceeds to step 206, in which handoff is triggered and the target selection process begins.

Fig. 1 illustrates a situation in which a call is handed off from one single-carrier region (the first cellular communication 10a) to another single-carrier region (the second cellular communication network 10b). It will be recognized,

however, that there may be situations in which a call will need to be handed off between a multi-carrier region and a single-carrier region or to an AMPS network. For example, as illustrated in Fig. 3, in areas of high traffic, it may be beneficial to deploy a second CDMA network operating on a second frequency (f_2) over a first CDMA network operating on a first frequency (f_1). As shown in Fig. 3, a coverage map of the region would show single carrier (f_1) coverage by the first CDMA network, as represented in Fig. 3 by single-carrier cells C10, C11, and C12, and a core of dual-carrier coverage (f_1 and f_2) by the combination of the first and second CDMA networks, as represented by dual-carrier cells C13, C14, C15, and C16. It will be recognized that each of the single-carrier cells C10, C11, and C12 is served by a single BTS1, while each of the dual-carrier cells C13, C14, C15, and C16 is served by two BTSes, including a BTS1 and a BTS2. Alternatively, the dual-carrier cells C13, C14, C15, and C16 may be served by a single BTS with multiple carriers. The dual-carrier cells bordering single-carrier cells, in this case, dual-carrier cells C13, C15, and C16, are designated as boundary cells. As described above with respect to Fig. 1, the boundary cells C13, C15, and C16 are bi-sectored cells oriented normal to the single-carrier/multi-carrier boundary, although it will be recognized that the cells C13, C15, and C16 may be omni-, three-, or six-sectored cells as needed.

As a mobile unit 300 traveling within the dual-carrier cell C16 and communicating on the frequency f_2 moves away from the core toward the area of single-carrier coverage, i.e., in a direction indicated by an arrow B, an active call of the mobile unit must be handed off to the frequency f_1. In this situation, the boundary sector trigger operates in the same manner as described above, with dual-carrier cells C13, C15, and C16 being designated as boundary cells, as mentioned above. It will be recognized that in this alternative embodiment that no additional hardware is required, as each of the boundary cells C13, C15, and C16 already includes appropriate hardware for serving both frequencies, i.e., a BTS1 and a BTS2.

Although illustrative embodiments of the invention have been shown and described, other modifications, changes, and substitutions are intended in the

foregoing disclosure. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

WHAT IS CLAIMED IS:

1. A method for triggering hard handoff of a mobile unit call from a first sector in a first cellular communication network operating on a first frequency to a second sector in a second cellular communication network operating on at least one second frequency, the method comprising:

monitoring an active set of said mobile unit to determine whether said active set is a boundary active set comprising only boundary sector pilots;

responsive to a determination that an active set of said mobile unit is a boundary active set, measuring a round-trip delay ("RTD") of communications between said mobile unit and a base station transceiver subsystem ("BTS") of said first sector;

comparing said measured RTD with a predetermined RTD threshold; and

responsive to a determination that said measured RTD exceeds said predetermined threshold, executing a target selection process.

2. The method of claim 1 further comprising, responsive to said boundary active set reverting to a non-boundary active set prior to said initiation, terminating a current step and returning to said monitoring step.

3. The method of claim 1 further comprising, responsive to a determination that said measured RTD does not exceed said predetermined threshold, returning to said measuring step.

4. The method of claim 1 further comprising identifying at least one sector in said first cellular communication network as a boundary sector.

5. The method of claim 1 wherein said first sector forms a part of a first cell and said second sector forms a part of a second cell and wherein said first and second cells are co-located.

6. The method of claim 5 wherein said first and second cells each comprise two sectors.

7. The method of claim 1 further comprising, after said initiating, executing a handoff of said mobile unit call to a selected target sector.

8. The method of claim 7 wherein said selected target sector is said second sector.

9. The method of claim 1 wherein said first and second cellular communication networks are code division multiple access ("CDMA") networks.

10. The method of claim 1 wherein said first cellular communication network is a CDMA network and said second cellular communication network is a non-CDMA network.

11. A method of triggering hard handoff of a mobile unit call from a first base station transceiver subsystem ("BTS") at a first operational frequency to a second BTS at a second operational frequency, the method comprising:

monitoring an active set of said mobile unit to determine whether said active set is a boundary active set comprising only boundary sector pilots;

responsive to a determination that said active set is a boundary active set, measuring a round-trip delay ("RTD") of communications between said mobile unit and said first BTS;

comparing said measured RTD with a predetermined RTD threshold; and

responsive to a determination that said measured RTD exceeds said predetermined threshold, executing a handoff of said mobile unit call to said second BTS.

12. The method of claim 11 further comprising, subsequent to said measuring, responsive to a determination that said active set including at least

one non-boundary sector pilot, terminating a current step and returning to said monitoring step.

13. The method of claim 11 further comprising, responsive to a determination that said measured RTD does not exceed said predetermined threshold, returning to said comparing step.

14 The method of claim 11 wherein said first and second BTSes are located in the same cell site.

15. The method of claim 11 wherein said first and second BTSes serve co-located cells of different cellular communication networks.

16. The method of claim 15 wherein said co-located cells each comprise two sectors.

17. In a cellular communication network comprising a multi-carrier frequency region comprising multi-carrier cells each having at least one base station transceiver subsystem ("BTS") for enabling radio frequency ("RF") communication on a plurality of different frequencies and a single-frequency carrier region comprising single-carrier cells each having a single BTS capable of RF communication on a single frequency, a method for triggering hard handoff of a mobile unit call from said multi-carrier frequency coverage region to said single-frequency coverage region, the method comprising:

designating multi-carrier cells bordering on said single-carrier region as boundary cells, each of said boundary cells comprising at least one boundary sector;

monitoring an active set of a mobile unit within said multi-carrier region to determine whether said active set is a boundary active set comprising only boundary sector pilots;

responsive to a determination that an active set of said mobile unit is a boundary active set, measuring a round-trip delay ("RTD") of communications

between said mobile unit and a BTS with which said mobile unit is communicating;

comparing said measured RTD with a predetermined RTD threshold;

responsive to a determination that said measured RTD exceeds said predetermined threshold, selecting a target; and

executing a handoff of said call to said selected target.

18. The method of claim 17 further comprising, responsive to said boundary active set reverting to a non-boundary active set prior to said initiation, terminating a current step and returning to said monitoring step.

19. The method of claim 17 further comprising, responsive to a determination that said measured RTD does not exceed said predetermined threshold, returning to said measuring step.

20. The method of claim 17 wherein said BTS with which said mobile unit is communicating comprises a first one of said at least one BTS of one of said multi-carrier cells and said target comprises a second one of said at least one BTS of said one of said multi-carrier cells and wherein said second one of said at least one BTS is capable of RF communication on the same frequency of said single-carrier cells.

21. The method of claim 17 wherein each of said boundary cells is a bi-sectored cell.

22. The method of claim 17 wherein said at least one BTS comprises a plurality of BTSes each capable of RF communication on a different frequency.

23. The method of claim 17 wherein said at least one BTS comprises a single BTS capable of RF communication on said plurality of different frequencies.

24. Apparatus for triggering hard handoff of a mobile unit call from a first sector in a first cellular communication network operating on a first frequency to a second sector in a second cellular communication network operating on at least one second frequency, the method comprising:

means for monitoring an active set of said mobile unit to determine whether said active set is a boundary active set comprising only boundary sector pilots;

means responsive to a determination that an active set of said mobile unit is a boundary active set for measuring a round-trip delay ("RTD") of communications between said mobile unit and a base station transceiver subsystem ("BTS") of said first sector;

means for comparing said measured RTD with a predetermined RTD threshold; and

means responsive to a determination that said measured RTD exceeds said predetermined threshold for executing a target selection process.

25. The apparatus of claim 24 further comprising means responsive to said boundary active set reverting to a non-boundary active set prior to said initiation for terminating a current step and returning to said monitoring.

26. The apparatus of claim 24 further comprising means responsive to a determination that said measured RTD does not exceed said predetermined threshold for returning to said comparing step.

27. The apparatus of claim 24 further comprising means for identifying at least one sector in said first cellular communication network as a boundary sector.

28. The apparatus of claim 24 wherein said first sector forms a part of a first cell and said second sector forms a part of a second cell and wherein said first and second cells are co-located.

29. The apparatus of claim 28 wherein said first and second cells each comprise two sectors.

30. The apparatus of claim 24 further comprising means for executing a handoff of said mobile unit call to a selected target sector.

31. The apparatus of claim 30 wherein said selected target sector is said second sector.

32. The apparatus of claim 24 wherein said first and second cellular communication networks are code division multiple access ("CDMA") networks.

33. The apparatus of claim 24 wherein said first cellular communication network is a CDMA network and said second cellular communication network is a non-CDMA network.

34. In a cellular communication network comprising a multi-carrier frequency region comprising multi-carrier cells each having at least one BTS for enabling radio frequency ("RF") communication on a plurality of different frequencies and a single-frequency carrier region comprising single-carrier cells each having a single BTS capable of RF communication on a single frequency, an apparatus for triggering hard handoff of a mobile unit call from said multi-carrier frequency coverage region to said single-frequency coverage region, the apparatus comprising:

means for designating multi-carrier cells bordering on said single-carrier region as boundary cells, each of said boundary cells comprising at least one boundary sector;

means for monitoring an active set of a mobile unit within said multi-carrier region to determine whether said active set is a boundary active set comprising only boundary sector pilots;

means responsive to a determination that an active set of said mobile unit is a boundary active set for measuring a round-trip delay ("RTD") of

communications between said mobile unit and a BTS with which said mobile unit is communicating;

means for comparing said measured RTD with a predetermined RTD threshold;

means responsive to a determination that said measured RTD exceeds said predetermined threshold for selecting a target; and

means for executing a handoff of said call to said selected target.

35. The apparatus of claim 34 further comprising means responsive to said boundary active set reverting to a non-boundary active set prior to said initiation for aborting a current step and returning to said monitoring.

36. The apparatus of claim 34 further comprising means responsive to a determination that said measured RTD does not exceed said predetermined threshold for returning to said measuring step.

37. The apparatus of claim 34 wherein said BTS with which said mobile unit is communicating comprises a first one of said at least one BTS of one of said multi-carrier cells and said target comprises a second one of said at least one BTS of said one of said multi-carrier cells and wherein said second one of said at least one BTS is capable of RF communication on the same frequency of said single-carrier cells.

38. The apparatus of claim 34 wherein said at least one BTS comprises a plurality of BTSes each capable of RF communication on a different frequency.

39. The apparatus of claim 34 wherein said at least one BTS comprises a single BTS capable of RF communication on said plurality of different frequencies.

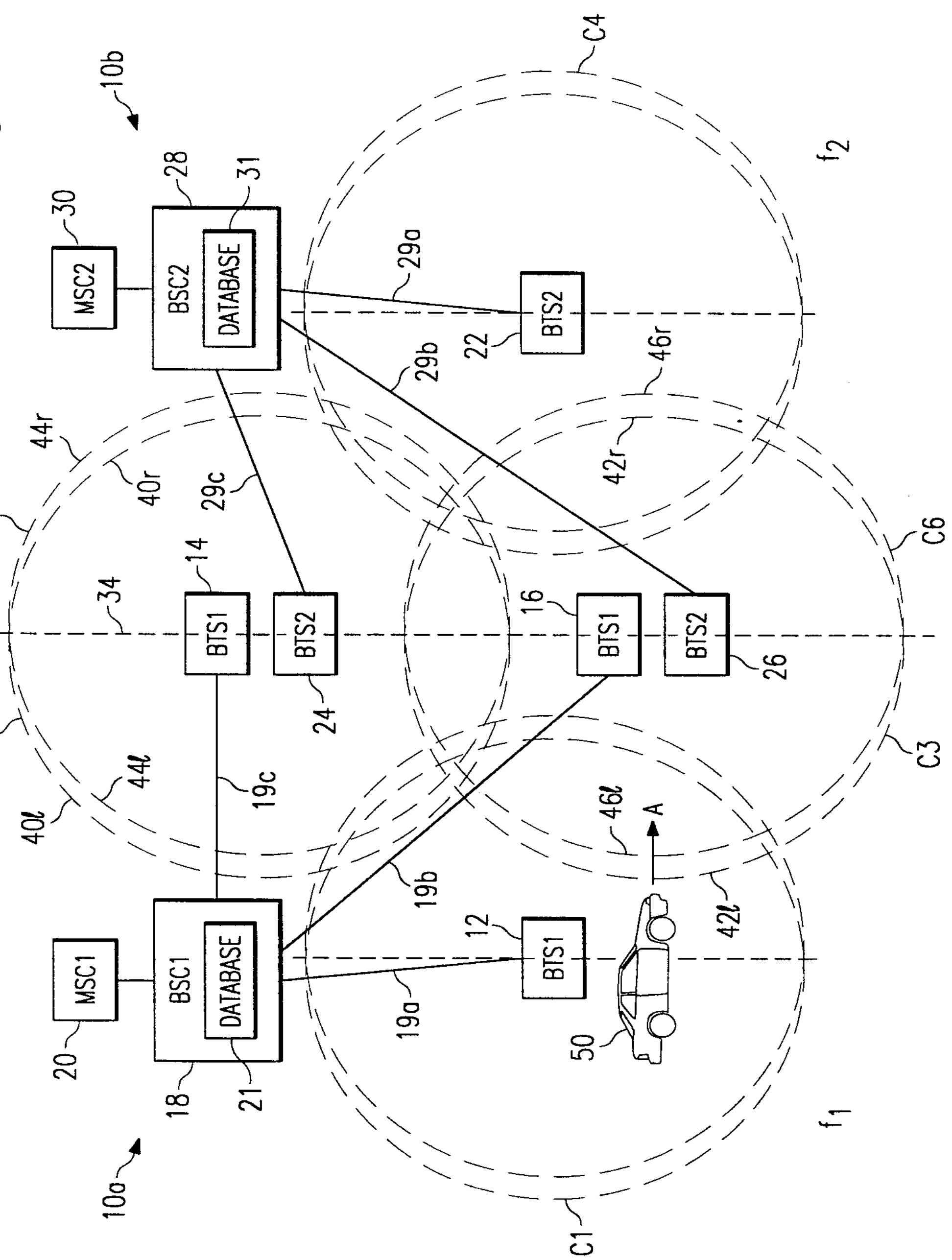
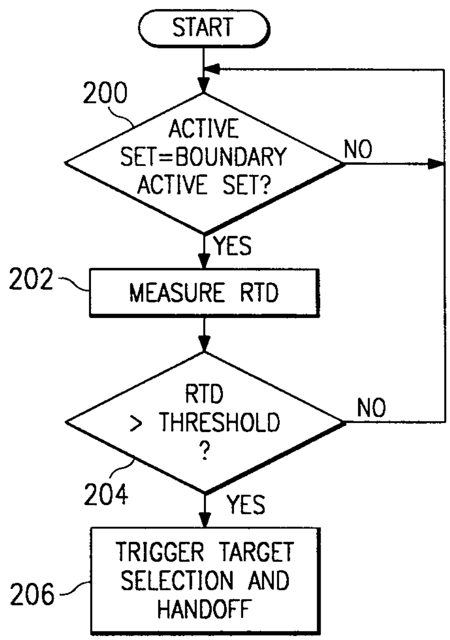

MSC1
BSC1
DATABASE
BTS1
BTS2
MSC2
BSC2
DATABASE
BTS1
BTS2
BTS1
BTS2
A
C1
C2
C3
C4
C5
C6
f_1
f_2
10a
10b

Fig. 1

Fig. 2


START
200
ACTIVE SET=BOUNDARY ACTIVE SET?
NO
YES
202
MEASURE RTD
RTD > THRESHOLD ?
NO
204
YES
206
TRIGGER TARGET SELECTION AND HANDOFF

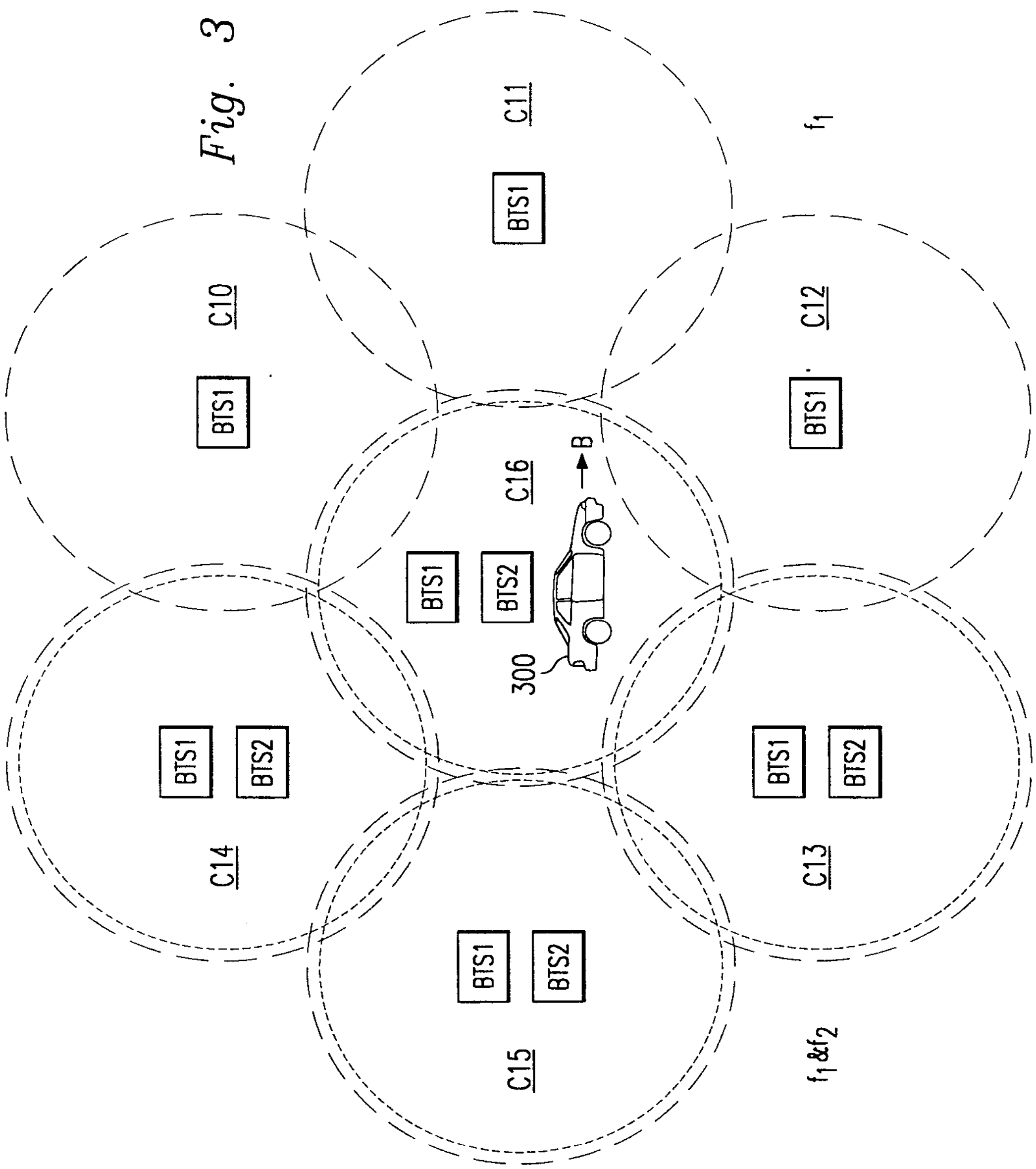

C11
BTS1
f1
C10
BTS1
C12
BTS1
C16
B
BTS1
BTS2
300
C14
BTS1
BTS2
C13
BTS1
BTS2
C15
BTS1
BTS2
f1&f2

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/09132

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04Q 7/00
US CL : 455/436
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/436,437,442,562,422,438,513; 370/335,332,331; 375/200

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,267,261 A (BLAKENEY, II ET AL.) 30 NOVEMBER 1993, SEE ABSTRACT	1-39
A	US 5,697,055 A (GILHOUSEN ET AL.) 09 DECEMBER 1997, SEE ABSTRACT	1-39
A,P	US 5,673,307 A (HOLLAND ET AL.) 30 SEPTEMBER 1997, SEE ABSTRACT	1-39
A,P	US 5,737,704 A (JIN ET AL.) 07 APRIL 1998, SEE ABSTRACT	1-39
A,P	US 5,649,000 A (LEE ET AL.) 15 JULY 1997, SEE ABSTRACT	1-39
A,P	US 5,634,192 A (MECHE ET AL.) 27 MAY 1997, SEE ABSTRACT	1-39

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
20 JUNE 1998

Date of mailing of the international search report
11 SEP 1998

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/09132

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,517,674 A (RUNE) 14 MAY 1996, SEE ABSTRACT	1-39